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14 September 2017

Bioeconomy Consultation,
Department of the Taoiseach,
Government Buildings,
Upper Merrion Street,
Dublin 2.

Re. Bioeconomy Consultation Document

Dear consultation coordinator,

Thank you for opening this consultation phase on the bioeconomy and inviting feedback on the National Policy Statement. The European Commission describes the bioeconomy as "Europe's response to key environmental challenges the world is facing already today. It is meant to reduce the dependence on natural resources, transform manufacturing, promote sustainable production of renewable resources from land, fisheries and aquaculture and their conversion into food, feed, fibre, bio-based products and bio-energy, while growing new jobs and industries." This description is potentially at odds with the OECD understanding of the term which is more limited to the role of biotechnological developments to generate economic activity.

In the development of a bioeconomy policy within Ireland it is important that we recognise the existing role of biological resources, ecosystem services and the ecological base that underlies our human needs for food, clean water and fresh air. It is this biological and ecological foundation that also underpins our economy and indeed makes human life, and the economies we engage in, possible. This should be an integral part of the bioeconomy definition (Question to section 1 of the discussion document).

This response has been structured based on the headings in the cover of the discussion document, which sum up the European Community aims for the bioeconomy, as set out below. The questions raised in the discussion document are also answered along with the responses set out below, but note that not all of your questions have been addressed in this response letter.

- Ensuring food security
- Moving from a fossil-based economy to a bioeconomy
- Unlocking the potential of seas and oceans
- Using better what we already use
- Using well what we don't use yet
- Long term sustainable development:
    - Natural resources management
    - Jobs and growth, competitiveness, inclusiveness
    - Global sustainability
    - Climate change
    - Responsible development with citizen sustainable consumption

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Ensuring food security

Ireland already has a strong agricultural economy, and as such this element of the bioeconomy is already well developed here. However our current model of agricultural production is limited by the many challenges that it poses to the natural environment, not least of which include the ongoing loss of soils and soil quality; deterioration of waterways and catchment hydrology; and impacts on global climate from greenhouse gas emissions. With the recognition and support of a dedicated bioeconomic sector however, these challenges can be overcome. Following are some examples of measures that fit directly into the category of utilising biological resources to achieve our aims of environmental protection (which is essential for long term food security in itself) alongside the production of food into the long term.

Planted buffer zones

Planted buffer zones are well known to provide protection of adjacent water courses[1]. These may include creation of 10m riparian buffer zones between all agricultural lands and water courses, increasing to 20-50m on steeply sloping lands. Such buffer zones would ideally be planted with deciduous tree species, and would be managed as continuous cover forestry rather than clear-felled. Such a programme would generate an on-farm timber products industry as well as protecting water courses from diffuse runoff. By trapping nutrient and silt runoff within the lower margins of our fields in such buffer zones, we can recirculate these back via food crop production within buffer areas (fruit and nut trees) or via biomass production (as willow or alder growth on a short rotation coppice for chipping as a compost material). These help to build the resilience of the soil itself, and thus greater food security.

Contour planting

Planting along the contour line on sloping lands assists with the infiltration of rainfall and the capture of runoff nutrients and soil. The Pontbren study in Wales[2] demonstrated the many benefits of this type of farm management, including farm productivity, livestock health, water quality protection, flood control and soil building and carbon sequestration. One of the measures carried out, for example, was tree and hedgerow planting along the contours, which allowed water to infiltrate into the soil up to 67 times more effectively than improved grazed land. Again, by protecting waters and soils we build our capacity to grow food into the longer term.

Agroforestry

Hand in hand with contour planting there is a great potential for agroforestry practices that combine timber production, food production and the ecosystem services provided by trees. Practices such as silvopasture, multistrata agroforestry and tree intercropping are all established agroforestry methods that can be used to create profitable, ecologically sound farming systems[3]. These can all have good application here in Ireland, given our excellent

1 Haycock NE, TP Burt, KWT Goulding and G Pinay (1996) *Buffer Zones: their processes and potential in water protection*. Quest Environmental, Hertfordshire, UK.

2 Keenleyside, C (2013) *The Pontbren Project - a farmer-led approach to sustainable land management in the uplands*. COED CADW Woodland Trust, Wales.

3 Toensmeier R (2017) *The Carbon Farming Solution – a global toolkit of perennial crops and regenerative agriculture practices for climate change mitigation and food security.* Chelsea Green Publishers, VT, USA.

timber growth rates and agricultural conditions. By combining food production and tree planting the benefits for our waters, soils and long term food security could be considerable.

Soil building

Soil humus has become greatly depleted over the past 50 years in Ireland and throughout the western world where artificial nitrate fertilisers have predominated. The high nitrate levels in humic soils liberates the carbon content[4], and denudes the soil of valuable humus which in turn damages the soil structure, drainage capacity, moisture holding capacity, nutrient storage and availability and biodiversity[5]. This has a direct deleterious effect on adjacent water bodies and underlying groundwaters in the form of diffuse runoff of silt, nutrients and agrochemicals. It also greatly undermines the potential for farming into the long term, which is seriously at odds with any endeavour to build robust security around our capacity to feed ourselves.

Soil humus can be rebuilt within our farms by composting animal manures and plant wastes, and by ploughing in green plant material and other regenerative agriculture techniques such as agroforestry and forest management within the farm, diverse cropping, mulch farming and the use of cover crops, conservation tillage and integrated nutrient management[6].

By contrast at present, much valuable plant material is sprayed off rather than ploughed in or composted, with implications for human health, soil health and the health of our water resources. Animal manures are applied as slurries rather than composted, so the carbon building potential is reduced[7] and soil and water then suffer. Instead, green manures and cover crops can hold the soil over the winter months and composting can be carried out relatively easily in winter storage sheds on a deep woodchip base[8]. These measures would help to filter runoff and also remove slurry as a potential water pollutant, as well as generating humus-rich compost to build soil carbon and revitalise, *inter alia*, our soil biodiversity, water health and flood control potential.

All of these measures fit directly within the overall realm of bioeconomic activities that can be developed as we move towards a more sustainable future in Ireland. These points above address the second question in Section 8 of the discussion document, while the first question is addressed by the majority of the points raised in this response.

At present, the primary driver in agricultural practice is the availability of funding for a particular farm activity. Thus overstocking, excessive spraying, hedge clearance and scrub removal, for example, have all derived ultimately from the need to fulfil the requirements for

4 Kahn, SA, RL Mulvaney, TR Ellsworth and CW Boast (2007) *The Myth of Nitrogen Fertilization for Soil Carbon Sequestration*. The Journal of Environmental Quality. Vol 37.

5 McKenny J. *Artificial Fertility: The Environmental Costs of Industrial Fertilizers.* In: Kimbrell A (ed., 2002) *The Fatal Harvest Reader - the tragedy of industrial agriculture*. Foundation for Deep Ecology, Ca, USA

6 Lal R (2004) *Soil carbon sequestration impacts on global climate change and food security.* Science 304, 1623 (2004).

7 Bot A and J Benites (2005) *The importance of soil organic matter - key to drought-resistant soil and sustained food productio*n. Food and Agriculture Organization of the United Nations, Rome.

8 Shirley C (1994) *Pig-powered composting: livestock can halp manage manure on your farm.* The New Farm, Sept/Oct 1994, pp.53-55, 60.

obtaining grant assistance and also increasing the availability of usable farmland for conventional crop production. None of this has helped to create true food security insofar as the impacts have a direct deleterious effect on the wider catchment within which our farms lie, and upon the health of those who we feed. It is insufficient to expect minority programmes such as REPS and GLAS to undo the damage caused by general farming policy requirements over many decades. However by implementing appropriate policy changes across the board within the existing payment structures, it is possible that a great change may be observed within farming in Ireland and that long term food security could become an overt focus of our practices and policies.

Moving from a fossil-based economy to a bioeconomy

If decarbonisation is to be adopted in a manner that will meet the targets set out in the Paris Accord, stepping down from all fossil energy sources will be needed as a matter of urgency. While the obvious elements of the bioeconomy will include biomass, bioethanols and other short carbon-cycle products, we will also need at meeting our needs without generating as much electricity or using as much energy as we do at present.

Utilising zero energy technologies is very different from energy efficiency *per se* or generating energy from renewable sources, and requires specific policy recognition. A very effective way to incorporate zero energy technologies into policy alongside efficiency and renewables is to introduce Feasta's *Cap and Share*[9] (capandshare.org) as a way to limit fossil fuel usage, and consequent greenhouse gas emissions globally. While this is not necessarily part of the bioeconomy as such, it would provide an excellent platform to fully reap the benefits that such an economy can offer and is also a seemingly indispensable tool for stepping back from the fossil-fuel economy. Cap and Share would also create the conditions for the cascading principle, circular economy and bioeconomy to flourish, as per the question in Section 7 of the discussion document. Similarly it addresses the third question raised in Section 8 about stimulating market demand.

Direct examples of how the bioeconomy can actively assist with the movement away from fossil fuel usage include the following:

- Bioenergy from willows grown on sewage treatment plant discharges can be used to mop up nitrates and phosphates. These nutrients currently cause serious water quality deterioration, but instead can provides a fertilizer source for willows plantations. This has already been used by Monaghan Co. Co. in just one example of municipal sewage treatment. They are also in common use in Denmark, a country with an excellent environmental track record.

- Biochar CHP boilers can generate both heat and power while at the same time creating biochar[10] as a valuable ingredient in fodder mixes for livestock and a

9 Johnson M, M Harfoot, C Musser, T Wiley, H Pollitt, U Chewpreecha and J Tarafdar. (2008) *A Study in Personal Carbon Allocation: Cap and Share*. Comhar – Sustainable Development Council, Dublin.

10 EOS Future Design, Ithaka Institute, Tipperary Energy Agency, University of Limerick and Premier Green Energy (2015) *PBX2 - Pyrolysis of Biomass for Power and Biochar*. Report by EOS Future Design, Dublin, funded under the SEAI Energy Research, Development and Demonstration Programme.

valuable soil improver. This has the potential to lower GHG emissions from cattle directly, create healthier soils, which in turn helps to address flooding issues seen in recent years. The biochar in itself is a very stable form of carbon for atmospheric carbon sequestration.

- Sewage treatment plant sludges can be sources of biogas via anaerobic digestion, as well as producing a nutrient rich digestate for agricultural use and therefore displacing high energy input fertilisers.

- Septic tank sludges would overload current municipal capacity if the National Inspection Plan were to be followed to the letter and tanks were to be maintained annually as recommended. Instead of this situation, collection of sludges for anaerobic digestion would stabilise the digestate and also prevent the overload of current municipal sludge treatment facilities.

- Domestic scale zero discharge willow facilities offer a dual benefit in that they mop up atmospheric carbon as they grow, using the nutrients from the septic tank, and can be used to offset heating fuel requirements in the house after routine coppicing maintenance. EPA Research Report[11],[12] findings suggest that these are excellent at protecting the local watercourses, and research from Denmark suggests that each willow facility will mop up as much carbon over 20 years as a mechanical treatment system will generated in that timeframe if the fuel wood is used to displace heating oil or electricity in the home.

- Reed beds and constructed wetland systems can achieve sewage treatment to a standard equal to or higher than mechanical systems, only with zero energy inputs. Thus by using the biological resources in the form of the reeds within the system, oxygen is introduced naturally into the root zone. This provides the right conditions for aerobic sewage treatment microorganisms to thrive and function. Filtration, oxidation and reduction reactions, sedimentation and other physical, chemical and biological mechanisms[13] all help to produce a cleaner effluent with no fossil energy inputs needed.

One of the principle challenges for moving towards the bioeconomy vs the fossil economy is the heavy ongoing subsidisation of the latter[14]. The chief economist of the International Energy Agency is on record as having said that eliminating global subsidies for coal, oil and

11 Gill LW., D Dubber, V O'Flaherty, M Keegan, K Kilroy, S Curneen, B Misstear, P Johnston, F Pilla, T McCarthy, N Qazi and D Smyth (2015) *EPA Research Report – Assessment of disposal options for treated wastewater from single houses in low-permeability subsoils*. EPA, Wexford.

12 Harty F (2016) Willow facility update: EPA research options for low-percolation sites. Engineers Journal online. https://www.engineersjournal.ie/2016/02/23/epa-research-report-on-solutions-for-low-permeability-subsoils/

13 Harty F and Otte ML (2003) *Constructed wetlands for treatment of wastewater*. In: Otte ML (ed.) *Wetlands of Ireland - Distribution, ecology, uses and economic value*. UCD Press, Dublin. pp 182-190.

14 Douthwaite R and D Healy. *Subsidies and Emissions of Greenhouse Gasses from Fossil Fuels.* A report to Comhar the National Sustainable Development Partnership on behalf of Feasta, the Foundation for the Economics of Sustainability and Friends of the Irish Environment. Comhar, Dublin.

gas could provide half of all carbon savings needed to prevent catastrophic climate change[15]. If the bioeconomy is to thrive in Ireland, we need to be clear and overt in halting all funding of the fossil energy. This should be an expressed part of our bioeconomy policy from the outset (addressing in part the question from Question 6 in the discussion document).

Unlocking the potential of seas and oceans

There is huge potential for greater utilisation of our coastal water waters as part of a growing bioeconomy. Alongside economic developments it is vitally important that we assess the health of our current fisheries and manage them with great care so that they continue to support us into the long term, and in their own right as a valuable habitat. In this context it's worth noting that Alaska is one of the few salmon regions of the world without salmon farming. Finfish farming was banned in 1989, partly to preserve the existing commercial salmon industry[16].

Perhaps as part of the bioeconomy endeavours that we establish here we could seriously rethink our salmon policies in Ireland and reinvest in getting our rivers and lakes back up to salmon quality; reintroduce the fish; call a halt on salmon farming; and reinvigorate a whole industry of wild salmon fishing. An example has already been set in the Moy catchment in Co. Mayo[17]. Hand in hand with this we can take serious measures to cut back on faecal pollution of Cork Harbour, where the oyster and clam fish farming causes minimal damage and could easily grow into a thriving industry supplying much of Europe with high quality shellfish. A further initiative could be the introduction of farm scale aquaculture, with ponds on farms for coarse fish farming as a low-impact, eco-friendly rural industry.

The bioeconomy is, always and by necessity, supported by a rich ecosystem base. We need to value and appreciate the low tech industries such as wild salmon farming, and to value and appreciate the degree of habitat protection needed to support them. By rebuilding a healthy ecosystem base in Ireland, one which has been greatly denuded over the previous half century, we can rebuild a truly sustainable basis on which to live and work.

Using better what we already use

Making better use of our current biological resource base is crucial if we are to move towards the sustainability that is identified in the discussion document. In addition to the areas of agriculture and sanitation which are addressed in more detail under other headings, the area of forestry comes to mind as an example.

Forestry as currently practiced in Ireland requires extensive land clearing at both planting and felling times. A straightforward way to provide high quality protection for waterways and soils, and thus the long term benefits provided by both of these foundations to the bioeconomy, is to amend forestry grants with careful forethought. If all forestry grants are given for continuous cover forestry only, such that the soil structure is protected at the time of

15 Clarke D (2012) *Phasing out fossil fuel subsidies "could provide half of global carbon target".* The Guardian, UK. http://www.theguardian.com/environment/2012/jan/19/fossil-fuel-subsidies-carbon-target

16 Pozonsky S (2013) *Saving the World from Farmed Salmon - one person at a time.* http://www.wildakgirl.com/2013/04/why-did-alaskan-ban-fish-farms.html

17 O'Grady MF (1996) *Salmonid riverine enhancement programmes in a tourist angling context.* In: Giller PS and Myers AA, Disturbance and Recovery of Ecological Systems. Royal Irish Academy, Dublin.

timber removal and not liberated to local drains, streams and rivers, this alone would have many benefits. Continuous cover forestry is already an option within Teagasc guidance[18], but needs to be adopted as a specific policy for grant payment in order to gain widespread adoption by the forest industry.

Hand in hand with this, active preference for deciduous cover would help to to ensure that the protection of water chemistry and biodiversity is enhanced, with benefits for aquatic habitats as well as biodiversity generally. It is also imperative that new forestry is diversified from Sitka monocultures to provide greater biodiversity protection, greater water pollution protection and economic protection against possible sitka beetle import from North America or other pest or disease which may impact on sitka much as the Dutch Elm Disease or Ash Dieback. The diversity of forest benefits, ecosystems services and products is vast in comparison to the very limited economic use we make of conifer plantations in Ireland. Development of coppice crops and crafts, biofuels, gourmet mushroom sales, mycoremediation technology development[19], agroforestry developments etc. are all possible industries that could be developed in a diverse forest bioeconomy.

Using well what we don't use yet

As a designer of sustainable sanitation systems and sewage treatment systems an obvious focus for the bioeconomy in this category is that of our human wastes, a potential reservoir of fertiliser and biomass. Instead of generating a net source of pollution and eutrophication of water bodies inland and around our coasts, sanitation could become a net source of humus and nutrients for use in agriculture.

Following are some specific areas where the bioeconomy could bring some distinct advantages for soils, waterways, climate, environment and human health:

- Rural septic tanks are still a persistent problem for groundwater in Ireland. A very easy way to overhaul septic tanks is to introduce a new percolation area with a good splitter system (recently developed in Co. Sligo by ribbit.ie) and plant the area with biomass willow trees over a modified pipe layout (to prevent root ingress and pipe clogging). These can be done without deviating from the EPA Code of Practice[20], but by adopting a willow planted trench infiltration type pipe layout along with the standard sizing for percolation areas recommended in the Code. Willows are already mentioned as having sewage filter potential in the EPA Code, but greater guidance is needed in order for local authorities to approve planning applications with confidence. The use of willows was demonstrated to have excellent environmental protection in a recent EPA study[21], and they have been used successfully in Denmark for effluent

18 Teagasc Forestry Development Department (2016) *Farm Forestry Series No. 19 – Continuous Cover Forest Management.* Teagasc Forestry Development Department, Athenry, Co. Galway.

19 Stamets P (2005) *Mycelium Running – How Mushrooms Can Save the World*. Ten Speed Press, Ca, USA.

20 Keegan M and F Clinton (2009) *Code of Practice – Wastewater Treatment and Disposal Systems Serving Single Houses (≤10pe)*. Environmental Protection Agency, Wexford.

21 Gill LW., D Dubber, V O'Flaherty, M Keegan, K Kilroy, S Curneen, B Misstear, P Johnston, F Pilla, T McCarthy, N Qazi and D Smyth (2015) *EPA Research Report – Assessment of disposal options for treated wastewater from single houses in low-permeability subsoils*. EPA, Wexford.

disposal to air as well as filtration *en route* to groundwater[22]. In this way, willows are the biological resource used as the conduit through which biomass and nutrients can be recirculated as either fuel or compost, while at the same time protecting the integrity of our waterways and water quality.

- On a similar note, the use of compost toilets is probably the most ecologically sound method of domestic sanitation. Compost or dry toilets reduce water use, avoid water pollution, recapture nutrients as a fertiliser, and recoup biomass[23] for soil building. "Composting units" are identified in the EPA Code of Practice, but without further elaboration and guidance (along with clear guidelines for treating grey water without the black water element from toilets) they are are generally not easy to get through the planning process. Compost toilets will probably remain a marginal interest, but humanure recycling from flush sewer infrastructure is also easily carried out, as exemplified in sites in Scandinavia[24] and elsewhere in Ireland and abroad. In the context of Irish policy for this area of the bioeconomy, for those who wish to use either in-sewer separators or dry toilets, all obstructions should be removed and their use should be encouraged, or at the very least permitted, at local authority environment and planning department level for all new or existing planning applications. They should specifically be included in the next EPA Code of Practice (currently in the drafting process). I have set out a range of eco-friendly and effective domestic sanitation options in my book Septic Tank Options and Alternatives[25], all of which make direct use of biological resources in achieving their treatment aims – be those resources wetland plants, willow trees or the microbial flora involved in effluent treatment.

- *Vis a vis* urban wastewater, development of a robust bioeconomy in Ireland may be able to muster the resources required for full secondary and tertiary treatment of *all* urban wastewater discharges. We are in a somewhat challenging situation in Ireland whereby the largest sources of sewage pollution come from the government that is trying to convince its population to reduce its septic tank pollution levels. When the banking sector needed bailing out a seemingly limitless amount of money was found to ensure that it continued. Only a fraction of this amount of money need be spent introducing a good level of sewage treatment to all our small, medium and large urban discharges. Much of the pollution problem occurs in estuaries, which from a bioeconomy development perspective, are amongst the most productive ecosystems on earth. Only by adequately protecting our waters and coasts can we hope to make full use of our fish, shellfish, algae and other marine resources.

22 Harty F (2016) *Willow facility update: EPA research options for low-percolation sites*. Engineers Journal online. Engineers Ireland, Dublin.

23 Dubber, D and L Gill (2013) *EPA STRIVE programme 2007-2013. Water Saving technologies to reduce water consumption and wastewater production in Irish households*. EPA, Wexford.

24 Vinnerås B (2001) *Faecal separation and urine diversion for nutrient management of household biodegradable waste and wastewater*. Institutionen for Iantbruksteknik, Swedish University of Agricultural Sciences Report 244, Uppsala, Sweden.

25 Harty F (2014) *Septic Tank Options and Alternatives – your guide to conventional, natural and eco-friendly methods and technologies*. Permanent Publications, Hampshire, UK.

- Due to the interrelationships between soil health and water, we can further improve our bioeconomy through building our soils and protecting our waters by gradually moving to a source separation sewer infrastructure whereby urine and faecal solids can be recouped for reuse and composting respectively as early in the sewer process as possible (as described by Vinnerås, 2001). By composting source-separated humanure the amount of carbon available to build soils and provide knock-on benefits for our waterways and groundwaters and coastal waters is doubled vs. composting of sewage sludges[26], so there are tangible benefits to developing a source separation infrastructure in Ireland as part of our bioeconomy initiatives. Whatever the methods used, recouping all nutrients and biomass from sewage treatment will be essential if we are to achieve ecological sustainability. The direct transfer of nutrients and biomass from field (as crops) to river (as effluents, whether treated or not) simply doesn't add up as a long term management practice.

- Hand in hand with urban wastewater treatment, our stormwater runoff must also be treated to a good standard prior to discharge if we are to protect our aquatic resources and habitats. This has the potential to be *c*.15% as polluting as raw sewage[27], so untreated discharges are no longer a viable option. Simple and cost effective constructed wetlands are already used by some counties for stormwater runoff, and for many new road and motorway projects. These protect water quality, buffer flood potential, regulate water supply levels and can also provide additional aquatic habitat within the catchment.

There are many other examples to be sure, but these are just some that are not typically considered, and new innovations in the area are needed to bring them into common usage.

Long term sustainable development

For long term sustainable development to be achieved we need to remember that all of our economic activity is possible only on the firm foundation of a healthy ecosystem base. Following are some thoughts relating to the different areas listed in the discussion document:

Natural resources management

- Prioritise recognition of ecosystem services provided by healthy soils, planted agricultural buffer zones, wetlands, woodlands etc. in flood control, water quality protection and habitat provision.
- Reward landscape management that is ecologically constructive rather than not. Just as we have financially rewarded the removal of wetlands, ditches, scrubland and woodland, we need to adjust these policies in order to reward farming practices that actively replace lost habitat and the ecosystems services that they provide.
- Recognise the inherent value of wild spaces in and of themselves, rather than as a component of a new emerging bioeconomy. Creation of robust boundaries to protect

26 Harty F (2016) *Closed Loop Agriculture for Environmental Enhancement: Returning Biomass and Nutrients from Humanure and Urine to Agriculture*. Feasta – The Foundation for the Economics of Sustainability, Cloughjordan.

27 Hammer DA (1993) *Constructed wetlands for wastewater treatment, an overview of a low-cost technology.* In: Costello C. *Proceedings of Conference on Constructed wetlands for wastewater treatment in Ireland*. Maxpro, Kinsale, Co. Cork.

wild space will inevitably spill over into bioeconomic benefits, but should be carried out for it's own sake nonetheless and let the benefits flow in their own time out of care for the earth.

Jobs and growth, competitiveness, inclusiveness

- *Vis a vis* jobs, the bioeconomy is one of the areas that has sustained all cultures throughout human history. Farming, fishing and foraging underpin our capacity to survive. It is only as we have moved to ever greater degrees of mechanisation in the wider economy that we have seen the beginnings of unemployment at all. Full recognition and support of the bioeconomy, in its many and varied forms, could help to bolster a rural diverse employment base perhaps not seen in living memory in Ireland.

- Growth is not always inherently a good thing. Cancer is growth that has run amok and even threatens to kill the organism in which it has its origins. Increasingly it is becoming apparent that our current economic model of infinite growth on a finite planet simply cannot work. As such the emergence of growing focus on the circular economy is a welcome development insofar as it begins to create a new language with which to step back from the ideology of growth for its own sake. If the bioeconomy can replace the fossil economy to the point where humanity can co-exist with other species without falling into complete self-destruction, it will have served more than may be hoped, but growth *per se* is something that we need to be very wary of.

- Similarly with competitiveness, there is the implication that somehow we need to be better than somebody else in order to win the day. Given the scale of the challenges that we face on a global scale, collaboration is what is called for rather than competition. There will be plenty work, just to move forwards and set about the task of creating more sustainable lifestyles and livelihoods.

- With regards to inclusiveness, I'm not sure what is intended by it in this context, however if we look at the alienation, unemployment and disenfranchisement that are the unfortunate byproducts of the current economic model, surely an economy founded on biological resources as its very basis will provide greater opportunities to those who have been marginalised by the existing system.

Global sustainability

- The term sustainable development was defined in the Brundtland Report[28] *Our Common Future* as "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs". In the relentless pressure on every habitat around the country and around the globe we have regularly pushed species to the point of extinction, habitats to the point of collapse, whole ecosystems to the brink of breakdown and beyond. This is not a happy legacy to leave to future generations. Perhaps by creating a robust policy as part of this

28 WCED (1987) *Our Common Future, Chapter 2: Towards Sustainable Development (The Brundtland Report)*. World Commission on Environment and Development, Oxford University Press. Oxford, UK.

discussion document process and then a constructive embrace of a bioeconomy that protects and builds the health of the planet upon which we live, we can steer to a course that we will be happy to leave as an inheritance to those who follow.

Climate change

- Climate change is potentially the unifying challenge that can bring humanity together for a common cause. Trade unions, environmental groups, peace workers, relief agencies, farming groups, industry leaders, governments, religious leaders and scientists are all coming together to highlight and address the need for change. The bioeconomy may be one of the tools that can be used to help find a solution. Hand in hand with Cap and Share to put a limit on fossil resource extraction, the bioeconomy may be able to help both with carbon reductions and also with making life more comfortable as we undertake the work of putting the necessary changes into practice.

Responsible development with citizen sustainable consumption

- Development, like innovation and movement, never ceases. The question remains whether we will choose development that perpetuates an outdated model of growth for its own sake, or development that moves our whole society towards truly sustainable lifestyles and livelihoods. Sustainable consumption is probably a lot less than our current levels, so we would do well to select more appropriate indicators of our countries' health than GDP.

These are just some thoughts on the bioeconomy discussion document. I would be happy to offer input or assistance at any stage in those areas that I am qualified to do so, such as water quality protection, carbon sequestration, sustainable design and eco-friendly sewage treatment and dry sanitation design.

Yours sincerely,

Féidhlim Harty